Notes RBG Edinb. 43(3):439–466 (1986)

A REVIEW OF BORNEAN ZINGIBERACEAE: II (ALPINEAE, CONCLUDED)

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ABSTRACT. The remainder of tribe Alpineae, *Etlingera* (incl. *Achasma*, *Geanthus* and *Nicolaia*), *Geocharis*, *Elettariopsis*, *Elettaria* and *Geostachys* are reviewed, with keys to the species. Two new species are proposed, *Etlingera sessilanthera* and *E. muluensis* as well as two new varieties, *Etlingera nasuta* var. *reticulata* and *Geocharis fusiformis* var. *borneensis*.

Since the publication of the first paper in this series (Smith, *Notes RBG Edinb.* 42:261–314, 1985), the decision to unite *Achasma* Griff., *Nicolaia* Horan. and *Geanthus* Val. under *Etlingera* Giseke (Burtt & Smith in *Notes RBG Edinb.* 43:235–241, 1986) makes it prudent to repeat the key to those genera of the tribe *Alpineae* in which the inflorescence is borne separately from the leaf-shoot.

TRIBE ALPINEAE

B. *Inflorescence borne separately from the leaf-shoot* (continued).

KEY TO THE GENERA (revised)

1. Inflorescence compact; bracts imbricate 2
\+ Inflorescence lax; bracts never imbricate 4

2. Inflorescence enclosed by an involucre of sterile bracts, fusiform or occasionally cyathiform; flowers opening 2–3 at a time . . . . . 1. *Hornstedtia* (pt. I, p. 289)
\+ Inflorescence with or without an involucre of sterile bracts, if present then involucre not markedly rigid, usually cone-shaped or flat-topped; often with many flowers open at a time 3

3. Sterile involucre absent; infructescence elongating with age; lip and filament not joined in a tube above the petals . . . . . 2. *Amomum* (pt. I, p. 295)
\+ Sterile involucre present (rarely reduced to 3–4 bracts); infructescence not elongating; lip and filament always joined to form a distinct tube above the petals . . . . . 3. *Etlingera* (*Achasma*, *Nicolaia*, *Geanthus*)

4. Lip and filament joined to form a distinct tube above the petals; free part of lip divided to at least $\frac{1}{2}$ way into two linear lobes 4. *Geocharis*
\+ Lip and filament not so joined; lip never deeply split . . . 5

5. Leaf-shoots few bladed; bracteoles open to the base; anther-crest prominent . . . . . 5. *Elettariopsis*
\+ Leaf-shoots frond-like, generally many bladed; bracteoles tubular; anther-crest absent or minute 6

6. Inflorescence prostrate, sometimes almost entirely subterranean
6. *Elettaria*
+ Inflorescence erect, always held above ground . . 7. *Geostachys*

3. Etlingera Giseke, Prael. Ord. Nat. Pl. 209, 229, 251 (1792); Burtt & Smith in Notes RBG Edinb. 43:239 (1986).

Syn.: *Ettlingera* Raeuschel, Nomencl. Bot., ed. 3, 1 (1797), orth. var.
Geanthus Reinw.—non Rafinesque (1814) nec Philippi (1884) nec Valeton (1914).
Achasma Griff., Not. Pl. Asiat. 3:411, 426 (1851).
Nicolaia Horan., Monogr. Scit., 32 (1862).
Phaeomeria [Lindley, Nat. Syst. Bot. ed. 2, 446 (1836) nom. inval. ex] K. Schum., Pflanzenr. Zing., 261 (1904).
Geanthus Val. in Bot. Jahrb. 52:43 (1914) non Rafinesque (1814) nec Reinwardt (1825) nec Philippi (1884).

The reasons for uniting *Achasma*, *Nicolaia* and *Geanthus* and the adoption of Giseke's name have already been discussed (Burtt & Smith in *Notes RBG Edinb.* 43:235–241, 1986). Then, as now, no attempt was made to introduce formal sections using the old generic names; far too much has yet to be learned of the genus as it occurs in Sulawesi (Celebes), the Philippines and New Guinea. It is, however, worth grouping the species known from Borneo and summarizing their characters informally:

Group A. Peduncle 60–130cm, held erect above the ground; involucral bracts spreading, very showy; flowers numerous; central lobe of the labellum not expanded; anther held more or less erect, thecae dehiscing in upper $\frac{1}{2}$–$\frac{2}{3}$. *E. elatior*, *E. pyramidosphaera.*

Group B. Peduncle very short, almost always entirely subterranean; involucral bracts usually at least partly embedded in the ground; central lobe of the labellum expanded; anther held at an angle to the free part of the filament.

B (i) Flowers numerous; petals more or less the same length as the calyx, the dorsal lobe not hooded over the anther; labellum (in the Bornean plants) plain red or with some white on the margin; anther-thecae dehiscing in the upper $\frac{1}{2}$–$\frac{2}{3}$ only, sparsely pubescent, the slits hair fringed. *E. triorgyalis, E. metriocheilos, E. littoralis.*

B (ii) Flowers 4–many; petals longer than the calyx, the dorsal lobe hooded over the anther; labellum red with some yellow centrally, rarely plain red; anther-thecae dehiscing more or less to the base, inner faces densely pubescent. *E. nasuta, E. punicea.*

Group C. Peduncle and involucral bracts as in group B; flowers many; central lobe of the labellum not expanded; anther held at an angle, thecae dehiscing more or less throughout their length; free part of filament absent. *E. sessilanthera.*

Group D. Peduncle and involucral bracts as in groups B and C, but involucre sometimes much reduced; central lobe of labellum not expanded; anther held erect or slightly angled, thecae dehiscing throughout their length or not. *E. brevilabris, E. pubescens, E. sanguinea, E. longipetiolata, E. brachychila, E. fimbriobracteata, E. muluensis.*

Etlingera is a large genus, with perhaps as many as 70 species,

distributed from the Himalayas and SW China through Burma, Thailand, Malaysia and Indonesia to New Guinea and N Queensland.

Anther-types

The different anther-types of group Bi and Bii are very distinctive (Fig. 1) and easily discernible from herbarium material. That of group A is, as far as is known, identical to Bi, whilst the single representative of group C approaches that of Bii. In group D we find a tendency towards partial dehiscence accompanied by, possibly, sterile basal spurs, but in *E. brevilabris* and *E. velutina* the thecae dehisce throughout their length.

KEY TO THE SPECIES

1. Inflorescence raised well above ground on a 60–130cm peduncle; labellum obscurely 3-lobed, central lobe not elongate 2
\+ Inflorescence almost wholly or partially embedded in the ground, rarely raised just above soil-level; labellum 3-lobed with or without an elongate central lobe or entire 3

2. Petioles to 4cm; inflorescence pyramidal; sterile bracts 8–12 × 2–3(–5)cm . . . . . 1. *E. elatior*
\+ Petioles to 0·5cm; inflorescence semi-globose; sterile bracts 7 × 1·5cm . . . . . 2. *E. pyramidosphaera*

3. Labellum 3-lobed, central lobe prominently elongate; anther held at an angle to the free part of the filament 4
\+ Labellum 3-lobed (central lobe never prominently elongate) or entire; anther usually held erect, if strongly angled then free part of filament absent 8

4. Petals c. the same length as the calyx; anther-thecae dehiscing in upper $\frac{1}{2}$–$\frac{2}{3}$ only, slits usually hair-fringed, inner faces of thecae never totally pubescent; labellum plain red or with some white at the edges 5
\+ Petals longer than the calyx, the dorsal lobe hooded over the anther; anther-thecae dehiscing more or less to the base, inner faces densely pubescent; labellum red with some yellow centrally, rarely plain red 7

5. Involucral bracts to 8 × 5cm, markedly striate; flowers 12–13cm long . . . . . 3. *E. triorgyalis* vel sp. aff.
\+ Involucral bracts 1–6 × 2–3cm, not markedly striate; flowers 9–10cm long. 6

6. Leaves sessile, lower surface densely appressed hairy; leaf sheaths with hairy cross pieces; labellum at least partially white edged . . . . . 4. *E. metriocheilos*
\+ Leaves petiolate (petioles 1–2·5cm), glabrous below; leaf sheaths more or less glabrous, striate; labellum plain red (in Borneo). 5. *E. littoralis*

7. Involucral bracts less than 1cm wide; labellum plain red; inflorescence possibly not embedded in the ground . . . . 6. *E. nasuta*
\+ Involucral bracts 1·5cm or more wide; labellum red usually with some yellow in the centre; inflorescence partially embedded in the ground . . . . . 7. *E. punicea*

8. Sterile involucre reduced to 2–4 white bracts; flowers few, up to 12cm long, deep red with a white stigma . . . 9. *E. brevilabris*
\+ Sterile involucre of many bracts, never white; flowers many, up to 10cm long, red or red and yellow; stigma, where known, red or pink 9

9. Anther sessile, arising directly on and held at a right angle to the tube formed above the petals; labellum prominently 3-lobed, median lobe c.2cm wide . . . . . 8. *E. sessilanthera*
\+ Anther with a distinct filament, held erect; labellum more or less entire (rarely shortly emarginate), if distinctly 3-lobed then median lobe under 1cm wide 10

10. Leaves conspicuously hairy below; involucral bracts densely hairy marginally, lip entire, shortly emarginate . . 10. *E. pubescens*
\+ Leaves glabrous or hair confined to margins and midrib; bracts not as above; lip not emarginate 11

11. Petioles 7–9cm long 12
\+ Petioles less than 4cm long or leaves sessile 13

12. Petals yellow; anther crested . . . . . 11. *E. sanguinea*
\+ Petals red; anther crest rudimentary . . . 12. *E. longipetiolata*

13. Labellum red with a yellow margin or plain red, more or less equal to the stamen in length 14
\+ Labellum yellow, occasionally orange centrally, up to 1·5cm longer than the stamen 15

14. Leaves sessile; ligule ciliate; labellum red with a yellow margin 13. *E. sp. nov.*?
\+ Leaves with a 1·5–2cm petiole; ligule glabrous; labellum red 14. *E. brachychila*

15. Anther-crest prominent; receptacle of the inflorescence short, usually under 1cm . . . . . 15. *E. fimbriobracteata*
\+ Anther-crest absent or reduced to a thickened rim; receptacle of the inflorescence 3–4cm long . . . . . 16. *E. muluensis*

1. Etlingera elatior (Jack) R. M. Smith in Notes RBG Edinb. 43:244 (1986).

Type: W coast of Sumatra, Pulo Nias and Ayer Bangy, *Jack* s.n. (lost?).

Syn.: *Alpinia elatior* Jack, Mal. Misc. 2, 7:2 (1822), reimp. in Hook., J. Bot. 1:359 (1834).
Elettaria speciosa Bl., Enum. Pl. Jav., 51 (1827).
Nicolaia speciosa (Bl.) Horan., Monogr. Scit., 32 (1862).
Nicolaia elatior (Jack) Horan., Monogr. Scit., 32 (1862).

Bornean material seen:

SARAWAK. 3rd Division, Hose Mts, Sungei Melinau, inflorescence on a 2ft peduncle, flowers and bracts pink to red, edge of labellum yellow, 23 viii 1967, *Burtt & Martin* B5141 (E); 4th Division, Niah FR near the entrance to Plot 10, peduncle 3–4ft, bracts pink, turning brown after

flowering, calyx pink below, light red above, labellum red, edged yellow, 27 vi 1975, *Burtt* 8360 (E).

E. elatior is widely distributed throughout Malaysia and Indonesia and is often cultivated for its young flower buds which, in the Malay Peninsula at least, are an important ingredient of the spicy dish 'Laksah'. The colour of the involucral bracts varies from pink to bright scarlet and the red labellum is yellow or white at the margin. The more or less spherical capsules are 2–2·5cm in diameter.

2. Etlingera pyramidosphaera (K. Schum.) R. M. Smith in Notes RBG Edinb. 43:249 (1986).
Syntypes: Sarawak, 3rd Division, prov. Bintulu, Tubao, ix 1867, *Beccari* 4042 (K); Kalimantan, prov. Pontiak, Sungei Kanta, v 1867, *Beccari* 3452 (FIR); Sulawesi, SE, Lepo-Lepo, near Kandari, vii 1874, *Beccari* s.n. (n.v.).
Syn.: *Phaeomeria pyramidosphaera* K. Schum. in Bot. Jahrb. 27:306 (1899).
Nicolaia pyramidosphaera (K. Schum.) Burtt & Smith in Notes RBG Edinb. 31:315 (1972).
No recent material has been seen.

E. pyramidosphaera is distinguished from *E. elatior* by the much shorter petioles, narrower involucral bracts and the semi-globose, rather than pyramidal inflorescence. The species probably also occurs in Sumatra; whether Schumann's Sulawesi syntype is the same thing is doubtful.

3. Etlingera triorgyalis (Bak.) R. M. Smith in Notes RBG Edinb. 43:250 (1986). Fig. 1A.
Type: Malay Peninsula, Perak, *King's collector* 2105 (K).
Syn.: *Amomum triorgyale* Bak. in Hook. f., Fl. Brit. Ind. 6:237 (1892).
Hornstedtia triorgyale (Bak.) Ridley in J. Str. Br. Roy. Asiat. Soc. 32:144 (1899); K. Schum., Pflanzenr. Zing., 196 (1904).
Achasma triorgyale (Bak.) Holtt. in Gard. Bull. Sing. 13:186 (1950).
?*Hornstedtia winkleri* Ridley in Bot. Jahrb. 44:530 (1910). Type: Kalimantan, between Lumo Sibak and Muarah Benangin, viii 1908, *Winkler* 3175 (WRSL).
The following Bornean material may belong here:
SARAWAK. 1st Division, Padawan distr., G. Manok, on slope with bamboo, pure red flowers, 13 v 1973, *Burtt* 8117 (E); 7th Division, Belaga distr., Bukit Lobang, S of Punan Lusong, wet forest floor, pure red flowers, 25 viii 1978, *Burtt* 11305 (E).

E. triorgyalis, which also occurs in Sumatra, is characterized by the broad (up to 5cm) bracts of the involucre which, in the dried state, are conspicuously striate and more or less glossy; the characteristic cyathiform inflorescence is less discernible from herbarium material. The Bornean plants differ in the sessile leaves and in the lack of red coloration on the lower surfaces of the young leaves; it is also doubtful if the inflorescence is as markedly cyathiform. Reilly (thesis, unpublished, 1982) has observed large globular glands on the style and in the throat of the corolla; these

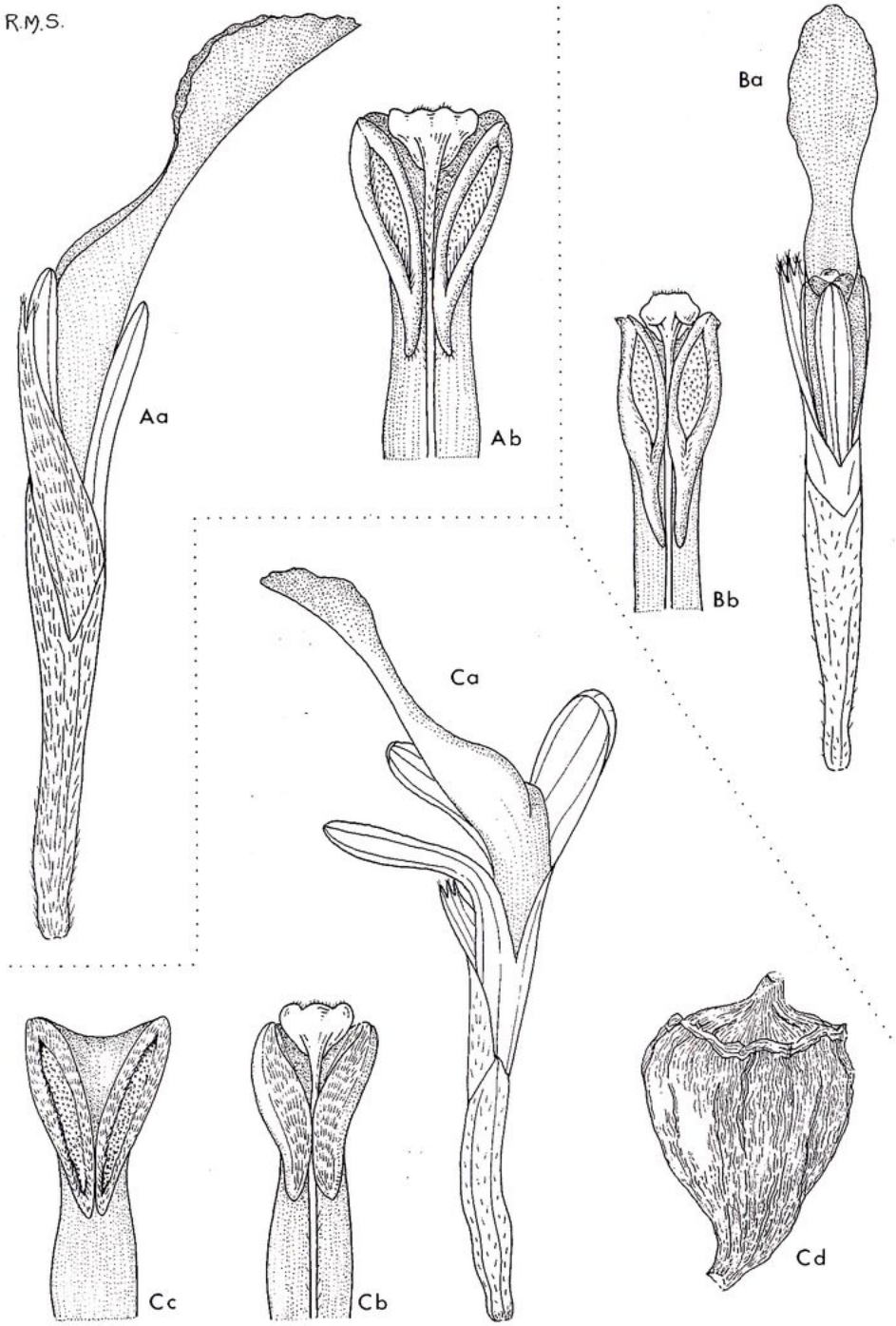

FIG. 1. A. *Etlingera triorgyalis* vel sp. aff.: a, flower with bracteole, lateral view ×1; b, stamen, stigma and upper part of style ×3. B. *E. littoralis*: a, flower with bracteole, dorsal view ×1; b, stamen, stigma and upper part of style ×3. C. *E. punicea*: a, flower with bracteole ×1; b, stamen (before dehiscence), stigma and upper part of style ×3; c, stamen (at dehiscence), stigma and style removed ×3; capsule ×1. (A from dried material of *Burtt* 8117; B from spirit material of *Argent & Walpole* 1455; C from dried material of *Burtt* 11484).

are not present on the Sarawak collections. These differences, in the light of our present knowledge of the genus, do not seem sufficient to warrant specific distinction. In the Peninsula the fruit of *E. triorgyalis* is said to be globose-obovate with a densely pubescent golden coat; a collection from Sumatra (*Lorzing* 5154, BO), reveals some ridging.

Hornstedtia winkleri is placed here tentatively. In general facies it much resembles the Sarawak plants, but it has not been possible to examine flowers and the labellum is described as red and yellow.

4. Etlingera metriocheilos (Griff.) R. M. Smith in Notes RBG Edinb. 43:247 (1986).

Type: Malay Peninsula, Malacca, Ayer Punnus, *Griffith* 5758 (K).

Syn.: *Achasma metriocheilos* Griff., Not. Pl. Asiat. 3:427, t. 356 (1851).

Amomum sphaerocephalum Bak. in Hook. f., Fl. Brit. Ind., 6:234 (1892). Type: Malay Peninsula, Penang, *Maingay*, Kew distr. no. 1581 (K).

Hornstedtia sphaerocephalum (Bak.) K. Schum., Pflanzenr. Zing., 192 (1904).

Hornstedtia spathulata Ridley in J. Str. Br. Roy. Asiat. Soc. 32:145 (1899). Syntypes: Sarawak, 1st Division, Mt Matang, *Ridley* s.n. (K); Puak, ix 1904, *Ridley* s.n. (K).

E. metriocheilos is the only species of Griffith's *Achasma* for which a type specimen is extant. Holttum was aware that *E. sphaerocephala* might be conspecific and the type matches *E. metriocheilos* reasonably well.

Other than the syntypes of *Hornstedtia spathulata* no Bornean material has been seen and Ridley's collections are by no means ideal. The species is variable, Holttum has described four varieties from the Peninsula, and the Sarawak plants have a short dense adpressed indumentum on the lower leaf surface which is absent from the types of *E. metriochelios* and *Amomum sphaerocephala*. The main features of the species are the labellum, which is plain red save for a white margin, and the anther which is similar to that of *E. littoralis* but bears more pubescence in the lower third.

5. Etlingera littoralis (König) Giseke, Prael. Ord. Nat. Pl. 209, 229, 251 (1792). Fig. 1B.

Type: Thailand, Phuket (olim Young Ceylon), *König* (specimen lost).

Syn.: *Amomum littorale* König in Retz., Obs. Bot. 3:52 (1783).

Achasma megalocheilos Griff., Not. Pl. Asiat. 3:426, t. 355 (1851). Type: Malay Peninsula, Johore, *Griffith* s.n. (specimen lost).

Bornean material seen:

SABAH. Lahad Datu, Lok Kalankali, Timbu Mata FR, damp places on hillside, 100ft, the bright scarlet flower grows at the base of the plant, sometimes 6–8in away, fruit edible, partly eaten by mouse deer (pelandok), 16 viii 1948, *Keith* (K); G. Tambuyukon, Kinabalu National Park, 1300m, hanging on wet rock face on side of ridge, flowers bright red at ground level, 11 iii 1980, *Argent & Walpole* 1455 (E).

E. littoralis is common throughout the Malay Peninsula and extends into lower Thailand. In its more southerly distribution it becomes rarer, and is apparently largely replaced in Borneo, Sumatra and Java by *E. punicea*. The species is most readily distinguished from *E. metriocheilos* by the glabrous, distinctly petiolate leaves, longer involucral bracts and the anther in which pubescence is more or less restricted to a conspicuous fringe of hair around the slits. No yellow has been noted on the flowers of the collections from Sabah; in the Peninsula yellow edged lips are frequent. No fruit has been seen on the Bornean material, in the Peninsula the capsules are said to be rather rounded with a short beak.

6. Etlingera nasuta (K. Schum.) R. M. Smith in Notes RBG Edinb. 43:248 (1986).

Type: Sarawak, 1st Division, Kuching, *Beccari* 315 (FIR).

Syn.: *Amomum nasutum* K. Schum. in Bot. Jahrb. 27:320 (1899) & Pflanzenr. Zing. 223 (1904).

Hornstedtia hewittii Ridley in J. Str. Br. Roy. Asiat. Soc. 46:241 (1906). Syntypes: Sarawak, 1st Division, Santubong, *Hewitt* s.n. (K); Siol, 28 ix 1905, *Ridley* s.n. (SAR).

Hornstedtia licmeres Ridley, op. cit. 49:44 (1907). Type? Sarawak, 1st Division, Kuching, 16 ix 1905, *Hewitt* s.n. (SAR).

Achasma nasutum (K. Schum.) Loesen., Pflanzenfam. Aufl. 2, 15A:596 (1930).

Material seen:

SARAWAK. 1st Division, Semengoh Forest Reserve, flowers rose-red, tube and lower part of lip pink, 13 vii 1961, *Burtt & Woods* B2477 (E); ibidem, wholly red flowers, young inflorescence with labellum scarcely radiant, growing out later, tip bilobed, 24 vii 1967, *Burtt & Martin* B4721 (E); 2nd Division, near Melegu, Kdg Tekalong, bracts and flowers light red, 9 ix 1978, *Bogner* 1385 (K).

E. nasuta has not been recorded from outside Sarawak where it has a seemingly restricted distribution. The species is most easily recognized by the rather reduced involucre which is composed of narrow (under 1cm) sterile bracts. The number of flowers per inflorescence is variable, the type specimen has probably no more than four, but the recent collections indicate that up to 10 to 12 may occur. Floral detail is very much as in *E. punicea* and Ridley records that the type of *Hornstedtia hewittii* has a central yellow band on the labellum.

There are indications that the inflorescence of *E. nasuta* is not deeply embedded in the ground—if at all—but field observations are needed to verify this. The leaves are up to 70cm long, glabrous except for some marginal hair towards the tips, the petioles are 1–2cm long and coriaceous, with a patch of short pubescence at the base. The glabrous leaf sheaths are obscurely reticulate.

var. **reticulata** R. M. Smith, **var. nov.** a *E. nasuta* var. *nasuta* ligulis brevioribus ciliatis et vaginis foliorum valde reticulatis differt.

Type: Sarawak, 4th Division, Mt Dulit, c.900m, edge of clearing in white sand forest, inflorescence appearing about 10cm from leaf-shoot, buried in

ground up to base of uniformly scarlet flowers, 15 ix 1932, *Richards* 1819 (holo. K).
SARAWAK. ibidem, c.800m, heath forest, flowers scarlet, inflorescence at some distance from leafy shoot, 3 x 1932, *Richards* 2119 (K).

The above are identical in inflorescence form to *E. nasuta*, but the vegetative parts are strikingly different; the short ligule (barely 5mm) is ciliate at the apex and the leaf sheaths strongly reticulate, the leaves, which are up to 25 × 6cm have a distinctly reticulate venation which is clearly visible to the naked eye on the lower leaf surface of the herbarium specimens. The diagnostic value of such a character has yet to be assessed, it has been noted, to a lesser degree, in some collections of *E. punicea*.

Beccari 4012 (FIR, photo E) from Tubao in prov. Bintulu, which Schumann suggested might belong to *E. nasuta* may represent this variety, but without re-examination of the specimen it is not possible to be conclusive.

7. Etlingera punicea (Roxb.) R. M. Smith in Notes RBG Edinb. 43:249 (1986). Fig. 1C.
Lectotype: *Icones Roxburghianae* 2007 (K), based on a plant collected in Sumatra.
Syn.: *Alpinia punicea* Roxb., Fl. Ind. 1:73 (1820).
Elettaria coccinea Bl., Enum. Pl. Jav., 53 (1827). Type: Java, *Blume* s.n. (n.v.).
Achasma macrocheilos Griff., Not. Pl. Asiat. 3:429, t. 357 (1851). Type: Malay Peninsula, Malacca, Ayer Punnus, *Griffith* s.n. (specimen lost).
Amomum coccineum (Bl.) K. Schum. in Bot. Jahrb. 27:305 (1899); Val. in Ic. Bog. 2 t. 156, 157 (1904).
Achasma coccineum (Bl.) Val. in Bull. Inst. Bot. Buitenz. 20:93 (1904).
Hornstedtia punicea (Roxb.) K. Schum., Pflanzenr. Zing., 197 (1904).
Bornean material seen:
SARAWAK. 1st Division, Bau distr., B. Jebong, secondary jungle, 150ft, corolla red outside, lip yellow with red fringe, 6 vii 1970, *Lehmann* S30144 (E); B. Serapat, c.13 miles on Kuching–Simanggang road, on N side, forest between foot of cliff and stream, 25 vii 1967, *Burtt & Martin* B4753 (E); 3rd Division, Hose Mts, gorge of S. Simpurai, labellum with red tip and yellow haft, 14 viii 1967, *Burtt & Martin* B4923 (E); 4th Division, G. Mulu National Park, path from Melinau to Trekan, c.400ft, petals red, lip pink, somewhat frilled, yellow centrally in lower part, 18 vi 1975, *Burtt* 8323 (E); ibidem, Baram distr., S. Lansat, 200m, on steep slope in lowland rain forest, flowers red but pale, almost white under lip, 8 viii 1977, *Argent et al.* 703 (E); Lambir National Park, S. Lapoh, c.500ft, flowers light red, stigma white, margins of lip crinkled and inrolled, centre yellow, 17 ix 1978, *Burtt* 11484 (E); Bintulu, Ulu Segan, by river, sandy soil, subject to flooding, flowers bright pinkish-red, 23 viii 1968, *Wright* S27158 (K); 5th Division, Mt Murud, lower edge of moss forest, plain red

flowers, rather short for the genus (or not yet fully expanded), 28 ix 1967, *Burtt & Martin* B5279 (E); 7th Division, Belaga distr., c.2700ft, Linau–Balui divide, S. Jellini, red flower with labellum wings frilled transversely and weak yellow line down middle of claw, 2 ix 1978, *Burtt* 11408 (E); ibidem, hill just N of Long Linau, flower red except for centre of labellum below middle (yellow) and wrap round of wings which only have narrow red margins, 8 ix 1978, *Burtt* 11480 (E); Kapit distr., S. Bena area, bracts green with red edges, stream gulley bank, 23 iv 1980, *Burtt* 12956 (E).
SABAH. Above Kallang waterfall near Tenom, c.1100m, mossy forest on ridge, bright red inflorescence with orange centre to labellum for c. half the length, 22 ii 1980, *Argent* 1342 (E); Hot Springs, Ranau, 2000m, flowers bright scarlet, 16 vii 1967, *Price* 179 (K); Mesilau camp, 1964, *Poore* H261 (K); Kinabalu, Singh's Plateau, 3000ft, dipterocarp forest, flowers scarlet, 12 vi 1961, *Chew, Corner & Stainton* 1018 (K).
KALIMANTAN. 1893–94, *Hallier* 2284 (BO).

Valeton (*Bull. Inst. Bot. Buitenz.* 20:44, 1904) remarked that *E. punicea* and *Achasma coccineum* were closely allied, but Schumann was the first author to unite the species (*Pflanzenr. Zing.*, 197, 1904—sub *Hornstedtia*). The former's excellent figure of *Amomum coccineum* compares very well with the plant illustrated by Griffith under *Achasma macrocheilos*, and, although lacking the markedly broad dorsal corolla lobe found in most Bornean and Peninsular material and showing less detail, the Roxburgh painting clearly depicts a similar anther type and petals much exceeding the calyx in length.

E. punicea also occurs in Thailand and, possibly, lower Burma, and a wide range of material, including collections from Java and Sumatra has been examined. These show much variation, particularly in the indumentum of the vegetative parts, and the leaves, although most commonly sessile, may be shortly petiolate. However, it has not been possible to segregate this material into distinct groups. Three collections, *Burtt* 5279, 4923 & 12956, exemplify this; all show reticulate leaf venation similar to that found in *A. nasuta* var. *reticulata*, but do not possess another single character in common which would serve to separate them from the other exsiccata.

In Borneo, some yellow on the centre of the otherwise red labellum is usually present, concolorous flowers are rare. Due to the inrolling of the outer edges of the haft, the collector may be misled into believing the yellow to be marginal, and carefully observed field notes should be made. Similarly, the colour of the stigma should be recorded, Holttum (*Gard. Bull. Sing.* 13:189, 1950) states that in *E. punicea* (*Achasma macrocheilos*), as it occurs in the Peninsula, the stigma is almost white; its colour has rarely been noted in Borneo.

Only two fruiting collections (*Burtt* 11484 & *Lehmann* S30144) have been seen; the capsules are less strongly ribbed than those figured by Valeton for the Javan plant, but are similarly shaped, i.e. obovoid/obconical and more or less flat topped.

Similarly shaped fruit is found in a collection from G. Mulu (*Argent & Kerby* 630) which has been omitted from the above citations and may

represent a distinct taxon. The leaves are unusually long petiolate (2–4cm) and the flowers described as 'pink, red at the base'; the labellum is much less expanded than in *E. punicea* and the corolla tube bears a ring of hairs at the throat within.

8. Etlingera sessilanthera R. M. Smith in Burtt & Smith, in Notes RBG Edinb. 43:240 (1986).

Species *E. brevilabri* similis ob flores rubros et antheras ecristatas, sed inflorescentia multiflora et anthera sessili differt. Fig. 4A.

Herba ad c.3m alta. *Folia* petiolo 5cm longo; lamina 60 × 10cm, lanceolata, basi rotundata et leviter inaequilateralis apice breviter acuminata, glabra; ligula fere 2cm longa, integra, glabra; vagina tenuiter reticulata, plus minusve glabra. *Inflorescentia* radicalis, c.15cm ab fronda foliosa oriens; pedunculus 9cm; spica elliptica, conoidea, 9 × 3·5cm; involucrum sterile e bracteis numerosis pallide brunneis 4–5 × 2–2·5cm ovatis acutis; bracteae fertiles ad 9cm longae, anguste lanceolatae, apice rotundatae, glabrae; bracteolae c.6cm, unilateraliter profunde fissae, apice bilobae, lobis apicibus pilosis. *Flores* vivide rubri; calyx c.7mm, irregulariter tridentatus; corolla tubo calyce paulo breviore in fauce pubescente; petala c.2cm longa, apice rotundata; labellum et filamentum conjuncta, tubum 2cm longum supra petalorum basibus formantia; labelli pars libera 2 × 2cm, rubra, macula flava centrali ornata, triloba; staminodia lateralia absentia; stamen c.8mm, connectivo basali parvo e tubo 2cm longo angulo fere recto sustentum; filamento libero nullo, apice profunde divaricato, thecis tenuiter pubescentibus; stigma rubrum (?); glandulae epigynae c.4mm, crassae; ovarium c.4mm longum, apice piloso-fimbriatum triloculare, placentatione axili. Fructus ignotus.

Type: Sarawak, 4th Division, G. Mulu National Park, camp V, Melinau Gorge, 200m, on ground in lowland rainforest, bracts light brown, flowers bright red with a central yellow spot on the large lobe [lip], leaf from middle of shoot pressed, 29 i 1978, *Hansen* 201 (holo. C).

No additional material of *E. sessilanthera* has been seen. The type collection is not wholly satisfactory in that it consists of a single leaf (taken from the middle of the frond) attached to a portion of pseudostem, and a single inflorescence preserved in spirit. None the less it is entirely justifiable to designate this collection as the type of a new species; it may be clearly separated from other *Etlingera* on its combination of corolla characters. The anther of *E. sessilanthera*, which is joined to the top of the tube formed by the connate basal parts of lip and filament by a short hinge-like connective (there is no free filament), is bent over at an angle to the tube and enveloped by the broad lateral lobes of the labellum—this is exactly as in species 3–7 above. The central lobe of the labellum, although well-formed, does not elongate and approaches that of *E. fimbriobracteata* and *E. muluensis* (nos 15 & 16 below).

9. Etlingera brevilabris (Val.) R. M. Smith in Notes RBG Edinb. 43:243 (1986). Fig. 2.

Type: *Hort Bog.*, originally from Borneo (n.v.).

Syn.: *Achasma brevilabrum* Val. in Ic. Bog. 3: t. 202 (1906).

Geanthus brevilabris (Val.) Loesen., Pflanzenfam., 2 Aufl., 15A: 591 (1930).

Material seen:

SARAWAK. 3rd Division, Hose Mts, hill W of Ulu Melinau Falls, plain red flowers, only one or two in an inflorescence, 19 iii 1967, *Burtt & Martin* B4983 (E); 4th Division, Lambir National Park, Sungai Liam Libau, red except for white centre to lip, 19 ix 1978, *Burtt* 11536 (E); 7th Division, Belaga distr., hill just N of Ling Linau, young leaves mottled dull red, calyx and petals red, lip light red round margins, nearly white centrally, 8 ix 1978, *Burtt* 11479 (E).

SABAH. Tenom, near Kallang waterfall off mile 108, 1300ft, old secondary forest, brilliant blood red terrestrial flowers, 10 viii 1979, *Collenette* 1/79 (E); near Sook, interior residency, in dense primary forest, flowers bright red with white stigma, 20–30 viii 1977, *Gardner* 4 (E); Mt Kinabalu, Keung to Kiau, 30 x 1915, *M. S. Clemens* 9912 (BO, UC); Tawao, 14 miles from Brantian, flowers bright red apart from white stigma, 17 i 1976, *Stevens et al.* 538 (E); Tawao, Elphinstone prov., flowers in small erect clusters from the rhizomes, bracts pinkish white, buds and flowers, including the calyx, deep red, x 1922–iii 1923, *Elmer* 20619 (UC, K); ibidem, inflorescence scarlet, bracts whitish, *Elmer* 21403 (UC, K); ibidem, bracts whitish, corolla very dark red, *Elmer* 20644 (UC, K); Sandakan, Myburgh prov., inflorescence deep or rich red, except the whitish bracts which are usually just underground, x–xii 1922, *Elmer* 20163 (UC, K); Tikoeng, xi 1912, *Amdjah* 806 (BO).

This splendid plant can hardly be confused with any other Bornean *Etlingera*. It has much the largest flowers of the genus and is further distinguished by the few flowered inflorescence and the much reduced sterile involucre. The flowers are commonly deep bright red with a prominent white stigma, and the showy labellum is obscurely three-lobed. The stamen, which bears a filament almost equal to the anther in length, inclines, but the thecae are not sharply angled. There is no anther crest. Vegetatively, the leaves vary considerably in width—at least this is the impression given by herbarium material; they are shortly petiolate with glabrous, coriaceous ligules and are usually markedly unequal at the base.

The Elmer collections cited above were distributed as *Hornstedtia spathulata* Ridley (=*Etlingera metriocheilos*).

10. Etlingera pubescens (Burtt & Smith) R. M. Smith in Notes RBG Edinb. 43:248 (1986).

Syn.: *Geanthus pubescens* Burtt & Smith in Notes RBG Edinb. 31:314, f. 17A (1971).

Type: Sarawak, 5th Division, route from Bakelan to G. Murud below camp IV, streamside, flowers yellow with reddish calyx, anther and stigma, 4 x 1967, *Burtt & Martin* B5366 (holo. E).

Still known only from the type collection, *E. pubescens* is easily distinguished by the pubescent lower leaf surface and conspicuously ciliate margined bracts. The entire, shortly emarginate labellum is more or less the same length as the stamen, but is exceeded by the narrow petals; the

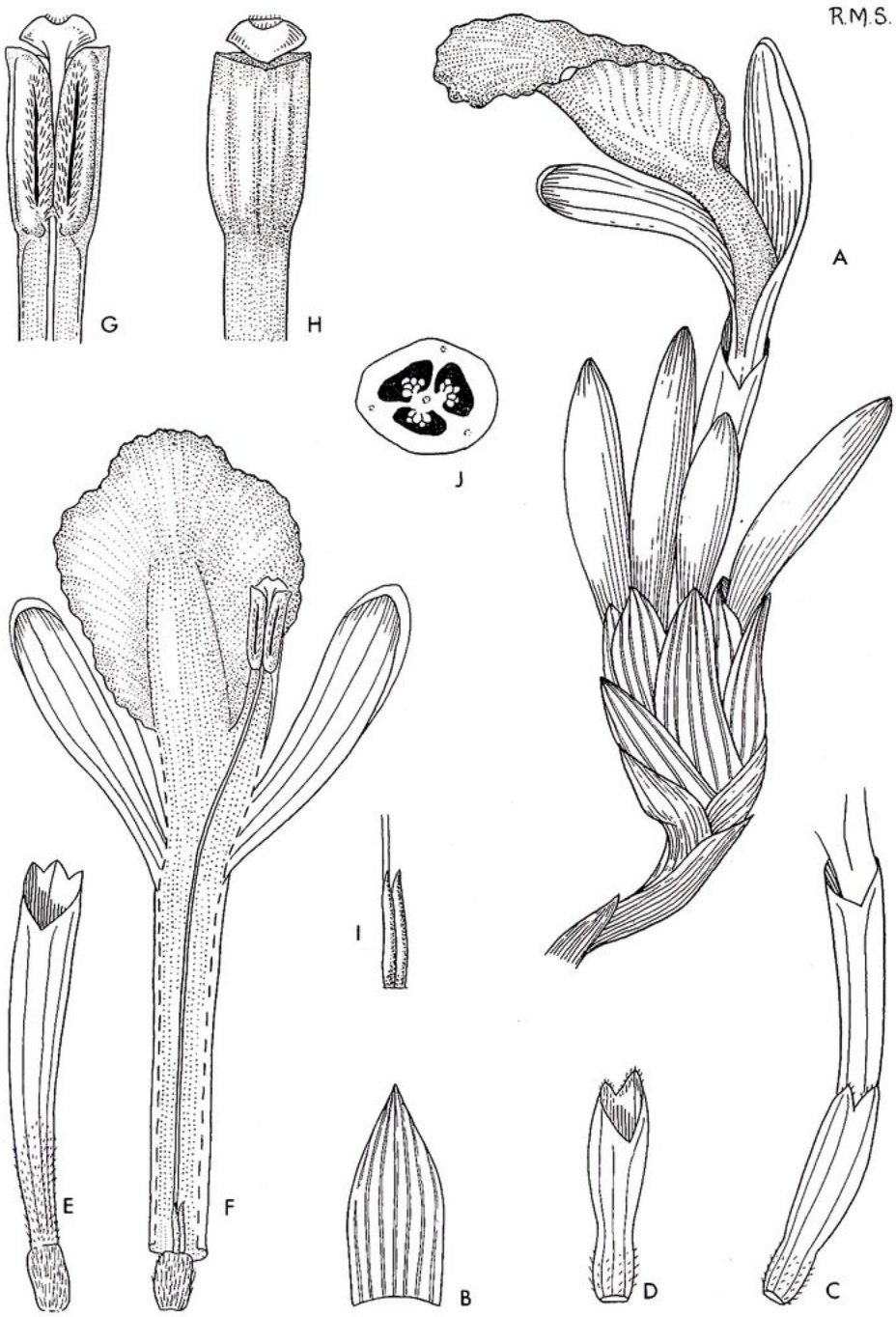

FIG. 2. *Etlingera brevilabris*: A, inflorescence ×1; B, fertile bract ×1; C, lower part of flower, showing calyx and bracteole ×1; D, bracteole ×1; E, calyx ×1; F, corolla, dissected ×1; G, H, stamen ×2; J, ovary in TS ×3; I, epigynous glands ×2 (from spirit material of *Burtt & Martin* B4983).

anther connective is very shallowly 3-lobed but is not prolonged into a crest.

11. Etlingera sanguinea (Ridley) R. M. Smith in Notes RBG Edinb. 43:249 (1986).
Type: Kalimantan, Hayup, peduncle red, bracts yellow with a red mucro, crest red, v 1908, *Winkler* 2147 (WRS, K, BM, G).
Syn.: *Hornstedtia sanguinea* Ridley in Bot. Jahrb. 44:531 (1910).
Geanthus sanguineus (Ridley) R. M. Smith in Notes RBG Edinb. 38:19 (1980).

E. sanguineus is characterized by the 7–8cm petioles and prominent reniform anther-crest. The type material is inadequate for dissection, but Ridley describes the limb of the labellum as dilated and subreniform. This and the presence of an anther-crest suggests an affinity with *E. fimbriobracteatus* (no. 15 below).

12. Etlingera longipetiolata (Burtt & Smith) R. M. Smith in Notes RBG Edinb. 43:247 (1986).
Type: Sarawak, 5th Division, Bakelan to Murud, camp IV, 2000m, petals light red, labellum bright yellow, stamen and stigma red, 2 x 1967, *Burtt & Martin* B5343 (holo. E).
Syn.: *Geanthus longipetiolatus* Burtt & Smith in Notes RBG Edinb. 31:313 (1972).

E. longipetiolatus differs from *E. sanguinea* in the rudimentary anther-crest and light red, rather than yellow petals.

13. Etlingera sp. nov.?
SARAWAK. 7th Division, Ulu Belaga, Sungei Semawat, c.250m, hill dipterocarp forest, clayey slope by stream, 1·8m, bracts brownish red, outer floral parts red, inner red with yellow margin, column red, 17 x 1981, *Hansen* 665 (C).

The above seems to represent a new species but the inflorescence (preserved in spirit) is incomplete and no perfect mature flowers are included. The subsessile leaves, which are rather thin textured for the genus, are glabrous except for the ciliate margins, and there is a prominent, over 1cm long, entire ligule. Unlike the succeeding species the labellum does not exceed the stamen in length. The densely pubescent anther is apparently ecristate. It is perhaps closest to *E. pubescens*.

14. Etlingera brachychila (Ridley) R. M. Smith in Notes RBG Edinb. 43:243 (1986).
Syntypes: Sarawak, 1st Division, near Kuching, flowers scarlet, lip very short, ix 1903, *Ridley* s.n. (K); Bau, vii 1903, *Ridley* s.n. (K).
Syn.: *Hornstedtia brachychila* Ridley in J. Str. Br. Roy. Asiat. Soc. 46:239 (1906).

No recent material of *E. brachychila* has been seen. The single inflorescence on the Kuching syntype is poorly preserved and few sterile

bracts can be observed; those present are narrowly lanceolate. Separately dried flowers of the Bau collection indicate that the species is indeed an *Etlingera*.

15. Etlingera fimbriobracteata (K. Schum.) R. M. Smith in Notes RBG Edinb. 43:245 (1986). Fig. 3A.

Type: Sarawak, 4th Division, Tubao R., trib. of Bintulu, viii 1867, *Beccari* 3735 (FIR).

Syn.: *Amomum fimbriobracteatum* K. Schum., in Bot. Jahrb. 27:317 (1899) & Pflanzenr. Zing. 252 (1904).

Geanthus fimbriobracteatus (K. Schum.) Burtt & Smith in Notes RBG Edinb. 31:312 (1972).

Material seen:

SARAWAK. 1st Division, Padawan distr., G. Manok, yellow flowers with red stigma, reddish fruits, 13 v 1975, *Burtt* 8131 (E); 4th Division, G. Mulu National Park, between S. Melinau & S. Terikan, c.450ft, flowers yellow with red stigma, fruits dull red in large spherical head, 15 vi 1975, *Burtt* 8283 (E); 7th Division, Belaga distr., S. Linau near Punan Lusong in secondary growth, calyx red in upper part, petals and lip bright yellow, anther-crest orange, stigma bright pink, fruiting head 9cm in diameter, very woody, seeds edible, 23 viii 1978, *Burtt* 11292 (E); Ulu Belaga Batang Belaga, c.250m, logged hill dipterocarp forest, clayey ground, bracts green, bract [calyx?] pinkish red, petaloid segments yellow, column yellow with red apex, 2 xi 1981, *Hansen* 940 (C).

The collections from Belaga, with their pubescent ligules and leaf margins match the type of *E. fimbriobracteata* well. The G. Mulu and G. Manok plants have glabrous, larger and extremely coriaceous ligules and the latter further deviates in the quite glabrous leaves and distinct petioles. However all agree in the prominent 2–3mm reflexed anther-crest, 3-lobed labellum and the short (less than 1cm) receptacle of the inflorescence. Furthermore, the fruits of *B*11292 and *B*8131 are identical to those of the type plant, the capsules are obovate, obscurely ridged, densely short pubescent and quite woody. A collection from Mt Murud (*Burtt & Martin* B5342) has a much reduced anther-crest, but is, in other respects, the same as the G. Mulu plant. More has yet to be learned of the variation which may be expected in this group of *Etlingera*.

In transferring *E. fimbriobracteata* from *Amomum* to *Geanthus*, Burtt & Smith (*op. cit.*) cited two collections (*Chai* S30376 and *Burtt & Martin* B5020) which are now placed in *E. muluense*.

Etlingera sp. (aff. *E. fimbriobracteata*)

SARAWAK. 5th Division, Bakelalan to Mt Murud, camp IV, 2000m, yellow flower, lip orange in centre, anther-crest orange, 1 x 1967, *Burtt & Martin* B5341.

This collection has the short receptacle found in *E. fimbriobracteatus*, but the anther-crest is much reduced. The leaves are very distinctive, they are narrowly lanceolate, 35 × 8cm, the bases narrowing into a c.1cm winged petiole. It may represent a new taxon.

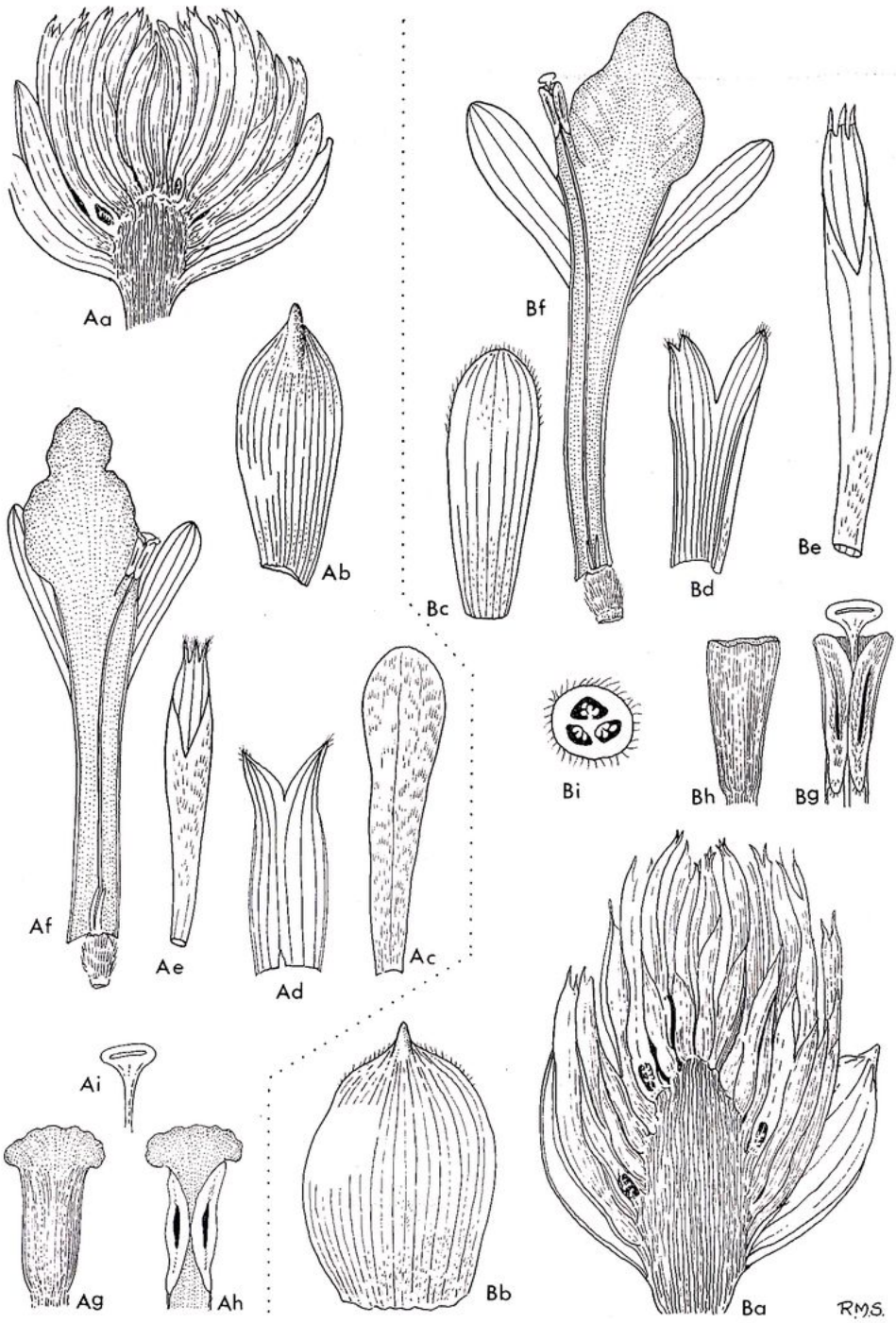

FIG. 3. A. *Etlingera fimbriobracteata*: Aa, inflorescence in LS ×⅔; Ab, sterile bract ×⅔; Ac, fertile bract ×1; Ad, bracteole, dissected ×1; Ae, calyx ×1; Af, corolla, dissected ×1; Ag, Ah, stamen ×3; Ai, stigma ×1. (Aa, from *Burtt & Martin* B5342; Ab–Ac from spirit material of *Hansen* 940). B. *E. muluensis*: Ba, inflorescence in LS ×⅔; Bb, sterile bract ×⅔; Bc, fertile bract ×1; Bd, bracteole, dissected ×1; Be, calyx ×1; Bf, corolla, dissected ×1; Bg, Bh, stamen ×2; Bi, ovary in TS ×2 (from spirit material of *Argent et al.* 1066).

16. Etlingera muluensis R. M. Smith, **species nova** ob labellum flavum obscure trilobum *E. fimbriobracteatae* similis, sed receptaculo inflorescentiae magis elongato et anthera ecristata differt. Fig. 3B.

Herba ad 3m alta. *Folia* subsessilia vel petiolata, petiolis c.2cm; lamina 30–100 × 7–12cm, lanceolata vel late lanceolata, basi rotundata, breviter caudato-acuminata, interdum pilis parcis marginalibus ceterum glabra; ligula c.1cm longa, integra, dense et longe pilosa; vaginae ciliato-marginatae. *Inflorescentia* radicalis, a fronda foliosa separata; pedunculus 1–2cm; spica 10 × 4–5cm, elliptica; receptaculum 3–4cm; bracteae steriles ad 4 × 2·5cm (apicem versus minores), mucronatae, leviter pubescentes, ad apicem ciliato-marginatae; bracteae fertiles multo angustiores, apice rotundatae, leviter pubescentes. *Flores* pro maxima parte flavi; calyx ad 5·5cm, tridentatus, triente superiore unilateraliter fissus, plus minusque glaber; corollae tubus calyce brevior; petala 2–2·5 × 0·4–0·6cm, apicibus rotundata, dorsale latissimum; labellum et pars filamenti inferior conjuncta tubum 1cm longum supra petalorum basibus formantia; pars libera labelli 1·2–1·5cm longa, leviter triloba, 1cm lata, lobis lateralibus obscuris, lobo medio 5mm lato; staminodia lateralia absentia; stamen c.1cm longum; filamenti pars libera 3–4mm longa; thecae pubescentes, crista ad marginem incrassatam redacta; stigma rubrum, validum; glandulae epigynae 3mm, inter se liberae; ovarium 4mm longum, dense pubescens, triloculare, placentatione axili. Fructus ignotus.

Type: Sarawak, 4th Division, G. Mulu National Park, W of Gua Payau, c.150m, on peaty accumulation of limestone boulder in low forest on small limestone hill, outer tepals yellow with deep tips, inner yellow, labellum creamy coloured, stigma prominent, dark red, 20 iv 1978, *Argent et al.* 1066 (holo. E).

Other material seen:

SARAWAK. 3rd Division, Hose Mts, Ulu Melinau Falls, flowers bright yellow except for dark red and hard stigma, 21 viii 1967, *Burtt & Martin* B5020 (E); 4th Division, G. Mulu National Park, G. Api, amongst tree roots and limestone rocks, yellow corolla, red stigma, 12 vi 1975, *Burtt* 8248 (E); ibidem, G. Api, limestone, on bank of a stream source on yellow sandy soil with sandstone pebbles, 500ft, calyx red, basal half of corolla tube white, upper yellowish, petals rich yellow, style white with a crimson stigma, 10 ix 1079, *Chai* S30376 (E).

E. muluensis resembles *E. fimbriobracteata* in the colour of the flowers and in the shape of the labellum which is obscurely three-lobed and longer than the stamen. It differs in the longer, 3–4cm, receptacle of the inflorescence, ecristate anther and in the shaggy haired ligule.

Imperfectly known species:

Etlingera velutina (Ridley) R. M. Smith in Notes RBG Edinb. 43:250 (1986).

Type: Sarawak, 1st Division, Bongaya R, x 1897, *Ridley* s.n. (K).

Syn.: *Hornstedtia velutina* Ridley in J. Str. Br. Roy. Asiat. Soc. 32:146 (1899).

There can be no doubt that the above belongs to the genus *Etlingera*, but to which group it is not possible to say. Ridley describes the labellum

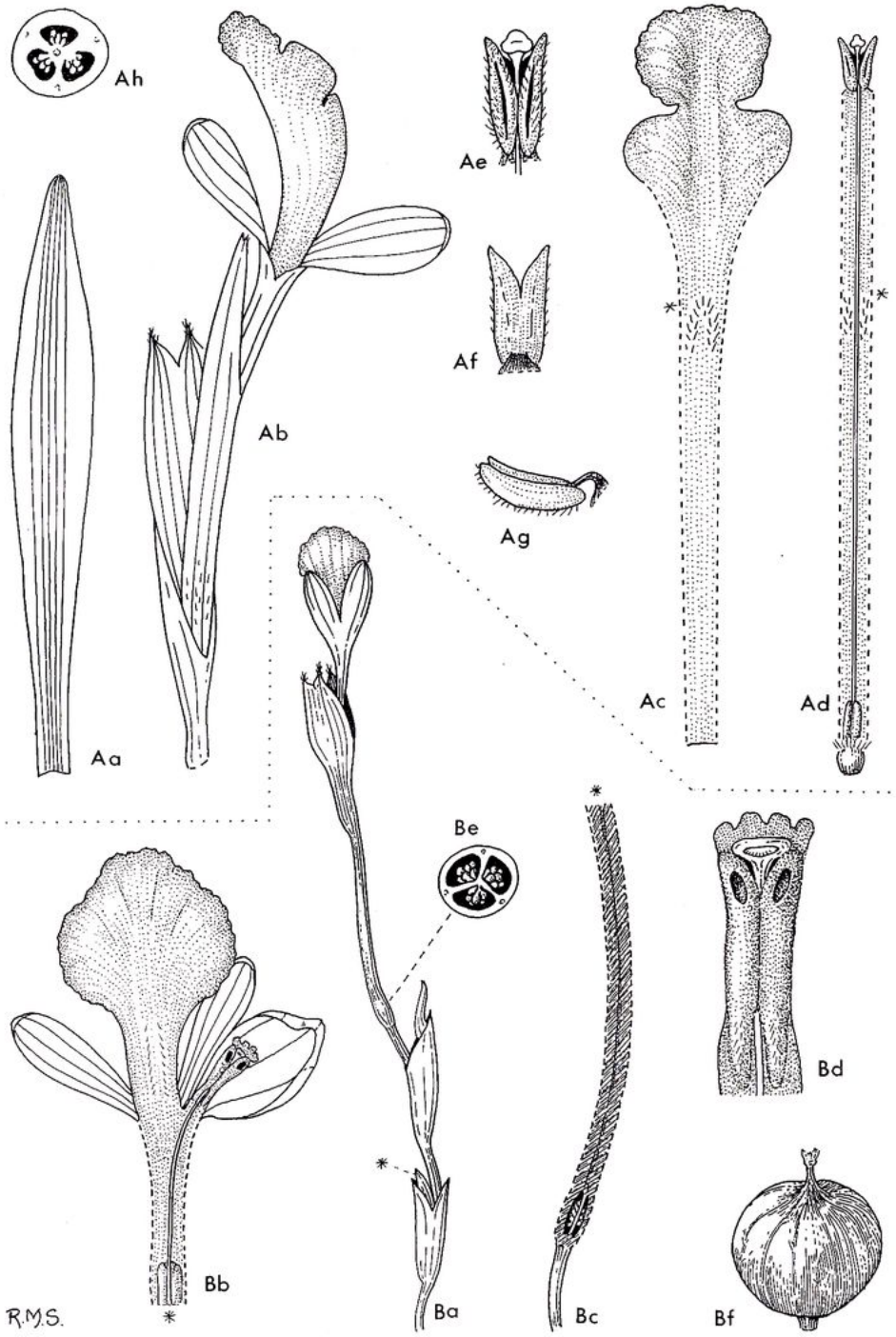

FIG. 4. A. *Etlingera sessilanthera*: Aa, bract ×1, Ab, flower, with bracteole ×1; Ac, Ad, corolla, dissected (* indicates position of petals) ×1; Ae, stamen from the front showing stigma and upper part of style ×1; Af, Ag, stamen from behind and side ×1; Ah, ovary in TS ×4 (from spirit material of *Hansen* 201). B. *Elettaria longituba*: Ba, cincinni (* indicating first, aborted? flower bud) ×1; Bb, upper part of corolla, dissected ×2; Bc, lower part of corolla in TS, showing solid portion above ovary ×2, Bd, stamen, showing stigma and upper part of style ×4; Be, ovary in TS ×4. (Ba from spirit material of *Burtt* 8284; Bb–Be from spirit material of *Hansen* 741).

as 'oblong rounded, bilobed, edges not meeting over the anther, cherry red, the edge at the base whitish'. He gives no measurement. Schumann (Pflanzenr. Zing., p. 192) states that the lip is 3cm long, but as the type specimen no longer bears complete flowers this cannot be verified. The leaves are densely pubescent below and the involucral bracts velvety.

4. Geocharis Ridley in J. Str. Br. Roy. Asiat. Soc. 50:143 (1908).

Geocharis, which also occurs in the Malay Peninsula, Sumatra and the Philippines, was formerly represented in Borneo by a single species, *G. rubra* Ridley. The inclusion here of *G. fusiformis* (Ridley) R. M. Smith (*Amomum fusiforme* Ridley) alters the circumscription of the genus, which is amended as follows:

Inflorescence radical, more or less erect or long prostrate (*Elettaria*-like), always lax. Bracts caducous or persistent, each subtending two flowers. Bracteoles probably always tubular, persistent or not. Calyx slender 3-lobed, usually just shorter than the elongated corolla-tube. Bases of labellum and filament joined to form a tube above the insertion of the petals. Labellum narrow, split to the base or to half way, into two linear lobes. Filament broad, more or less cymbiform, often subapically toothed. Thecae parallel, dehiscing to the base, connective crested. Fruit, as far as is known, narrowly elliptic, ridged or verrucose.

KEY TO THE BORNEAN SPECIES

1. Inflorescence erect, to c.20cm long; bracts and bracteoles caducous; filament subapically dentate . . . . . 1. *G. rubra*
+ Inflorescence prostrate, 25–30cm long; bracts and bracteoles persistent; filament edentate . . . . . 2. *G. fusiformis* var. *borneensis*

1. Geocharis rubra Ridley in J. Str. Br. Roy. Asiat. Soc. 50:146 (1908) Fig. 5B.

Type: Sarawak, 1st Division, Quop, flowers red, iii 1908, *Hewitt* (n.v.).

Material seen:

SARAWAK. 1st Division, G. Berumpet, Poi Range, near base, flowers red, 16 viii 1962, *Burtt & Woods* B2869 (E); Padawan distr., G. Manok, flowers yellow red, labellum yellow below, anther red, stigma white, calyx and pedicel red, 13 v 1975, *Burtt* 8129 (E); Bau distr., S end of G. Doya, above Kampong Seromah, foot of hill, forest floor among limestone rocks, bright red inflorescence and flower buds, 23 v 1975, *Burtt* 8190 (E); Klingkang Range, Sabal FR, 74th mile Kuching/Simanggang road, mixed dipterocarp forest, 1450m, flower buds red, fruits dark red, *Yii Puan Ching*, S41110 (AAU); Bidi, *Hewitt* s.n. (SING); s.l., 1980, *Hewitt* s.n. (K).

The type of *G. rubra* has not been located at K or SING but in almost all respects the above match Ridley's description well. There is but one serious discrepancy; Ridley states that the calyx is '$\frac{1}{4}$ of an inch long'; it may, in fact, reach 4cm. A possible explanation is that Ridley measured the bracts by mistake.

G. rubra is closely allied to the Peninsular *G. aurantiaca* Ridley which it resembles in the erect inflorescence, deeply bilobed lip and dentate

filament; it differs in the minute pubescence which clothes the entire lower leaf surface, much longer pedicels and in the colour of the flowers. When describing *G. aurantiaca* (op. cit., 144), Ridley, basing his species on a plant from Johore, also cited, presumably in error, the above *Hewitt* collection from Bidi.

2. Geocharis fusiformis (Ridley) R. M. Smith, **comb. nov.**
Syntypes: Philippines, Mindanao, Suriago, Biga creek, flower yellow or yellowish white, native name 'Loya-loya', iv 1906, *Bolster* 331 (K); ibidem, *Bolster* 224 (n.v.); Negros, iii 1908, *Elmer* 9509 (E).
Syn.: *Amomum fusiforme* Ridley in Phil. J. Sci. Bot. 4:171 (1909); Merrill in Univ. Calif. Publ. Bot. 15:31 (1929)—sub *Amomum* sp.

var. **borneensis** R. M. Smith, **var. nov.** a var. *fusiformi* ovario velutino et anthera glabra differt. Fig. 5A.
Type: Sabah, Myburg Province, Sandakan, clumps in dense forests, the stems erect about 1cm thick, flowering rhizomes above ground (apparently prostrate), red, flexible, the bracts grey and reddish-brown checked; flowers ascendingly curved, the corolla yellow except the red inside the tube and middle portion of the laid back upper lip, anther also deep yellow except the pale pink crest, x–xii 1921, *Elmer* 20218 (holo. UC, iso. K).
SABAH. Myburg Province, Sandakan, along Meliau R., Telapid, 20 x 1968, *Madani* SAN 63521 (K).

Merrill, who allowed the duplicates to be distributed under an unpublished binomial, pointed out that the *Elmer* collection from Sabah 'manifestly represents a form in the same group as the Philippine *Amomum fusiforme* Ridley'.

The type material of *G. fusiformis* is particularly poor, indeed good collections from both the Philippines and Borneo are needed, but it seems unlikely that we are dealing with more than a single species. In a note following his description, Ridley admitted that his placement of *Amomum fusiforme* in *Amomum* was provisional, and, while noting an alliance with *Geocharis*, suggested that the plant might belong to a new genus. Future researchers may agree with this opinion, and there is much about the species that is at variance with *Geocharis* as presently understood. The main differences are the *Elettaria*-like habit of the prostrate inflorescence (regrettably not so shown in Fig. 5A due to lack of space), persistent bracts and the absence of filamental teeth. However, and perhaps more importantly, *G. fusiformis* agrees with *Geocharis* in the flowers being borne in pairs, the presence of a distinct *Etlingera*-like tube above the petals, a narrow, deeply bilobed labellum (in this case to half-way only), a broad, more or less cymbiform filament, crested anther and elliptic capsule.

Plurifurcate (or stellate?) hairs occur to a marked degree on the calyx of var. *borneensis*; they are less obvious on the Philippine plant. Such hairs are not unique in the Zingiberaceae, they occur, for example, in some species of *Renealmia, Riedelia* and *Rhynchanthus*, and their diagnostic value above specific level is probably minimal.

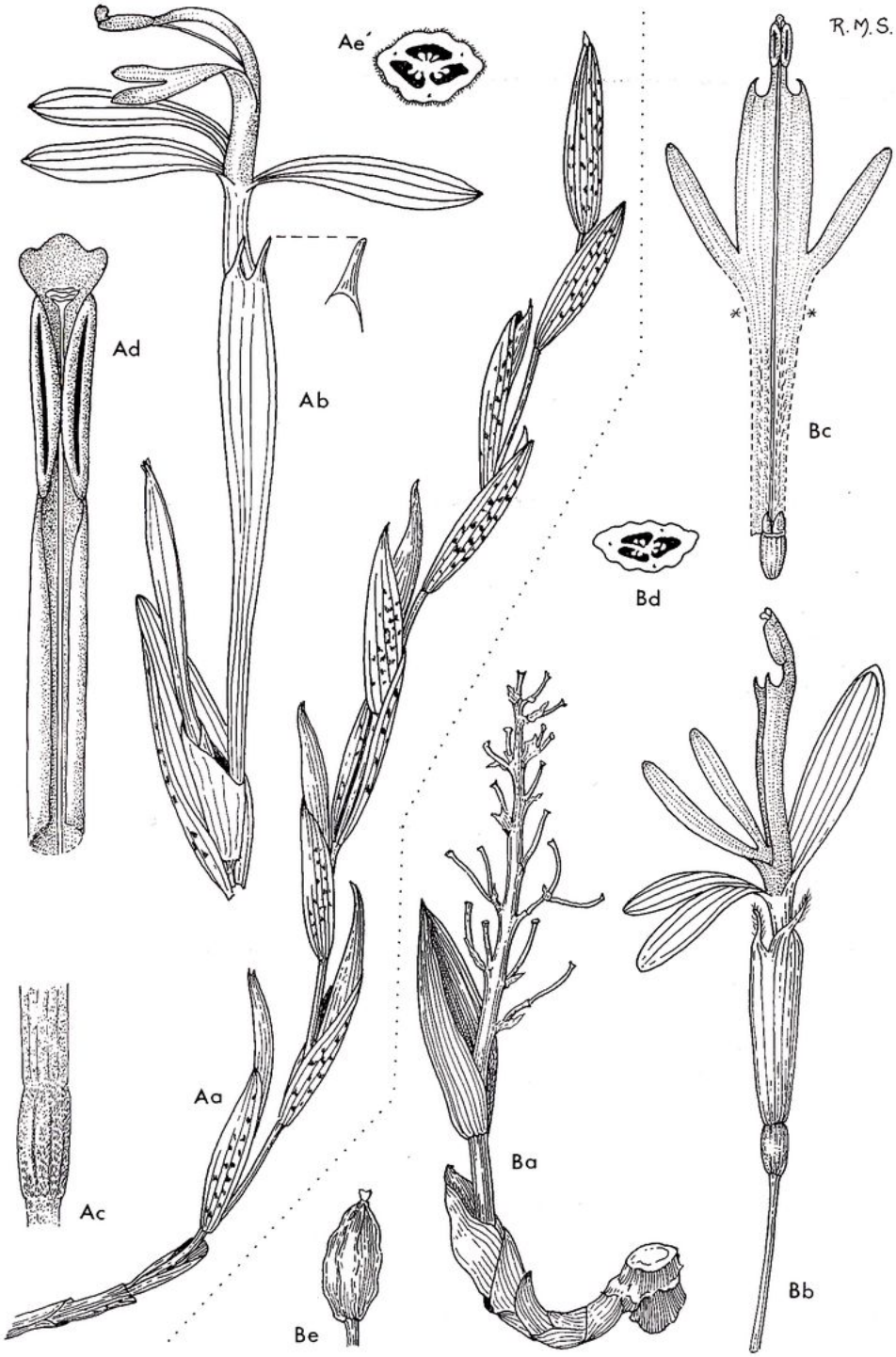

FIG. 5. A. *Geocharis fusiformis* var. *borneensis*: Aa, young inflorescence, habit $\times\frac{2}{3}$; Ab, cincinni, showing bract, bracteoles, mature and unopened flower $\times 1$; Ac, base of calyx and ovary $\times 2$; Ad, stamen $\times 2$; Ae, ovary in TS $\times 4$ (from dried material of *Elmer* 20218). B. *G. rubra*: Ba, old inflorescence, habit $\times\frac{2}{3}$; Bb, flower $\times 1$; Bc, part of corolla dissected, showing labellum, stamen and gynoecium (* indicates position of petals) $\times 1$; Bd, ovary in TS $\times 4$; Be, young fruit $\times\frac{2}{3}$ (from dried material of *Burtt & Woods* B2869).

The areolate sheaths and checkered, persistent bracts are a striking feature of *G. fusiformis*, and the fine adpressed hair of the lower leaf surface is similar to that found in *G. rubra*. The new variety is distinguished by the densely velutinous ovary and the glabrous anther.

5. Elettariopsis Bak. in Hook. f., Fl. Brit. Ind. 6:252 (1892).

Elettariopsis is characterized by the few-leaved shoots, thin expanded anther-crest, which is often longer than the thecae, and the obconic, triangular-mouthed stigma. For detailed observations on the genus see Kam in *Notes RBG Edinb.* 40:139 (1980).

There are about 8 species known at present, distributed from Indo-China, probably Thailand, to the Malay Peninsula and Borneo.

KEY TO THE BORNEAN SPECIES

1. Inflorescence much elongated (to 80cm); flowers borne in several flowered, remote cincinni . . . . . .3. ? *E. sp.*
+ Inflorescence to 18cm long; flowers borne singly 2

2. Inflorescence to 18cm long, many flowered; petioles 5–18cm long 1. *E. curtisii*
+ Inflorescence to 7cm long; flowers 5; petioles to 4cm long 2. *E. stenosiphon*

1. Elettariopsis curtisii Bak. in Hook. f., Fl. Brit. Ind. 6:252 (1892); Kam in Notes RBG Edinb. 40:142 (1980), fig. 1.

Type: Malay Peninsula, Penang, West Hill, *Curtis* 1578 (K).

Syn.: *Cyphostigma diphyllum* K. Schum., Pflanzenr. Zing. 272 (1904). Syntypes: Kalimantan, Banjarmassing, *Motley* 789 (n.v.); without precise locality, *Korthals* s.n. (L).

Elettariopsis diphyllum (K. Schum.) Loesen., Pflanzenfam. Aufl. 2, 15A:603 (1930).

No recent Bornean material of *E. curtisii* has been seen. It is widespread in the Malay Peninsula where it displays considerable variation in the vegetative parts and the leaf shoots may be single or up to four-bladed.

2. Elettariopsis stenosiphon (K. Schum.) Burtt & Smith in Notes RBG Edinb. 31:312 (1972).

Type: Sarawak, 2nd Division, Batang Lupar, Marop, iv 1867, *Beccari* 3311 (FIR).

Syn.: *Amomum stenosiphon* K. Schum. in Bot. Jahrb. 27:320 (1899) & in Pflanzenr. Zing. 244 (1904).

E. stenosiphon has not been recollected. It differs from *E. curtisii* in the shorter, more congested, few-flowered inflorescence and in the shorter petioles.

3. ? Elettariopsis sp.

SARAWAK. 4th Division, Lambir National Park, Sungai Liam Libau, flower white except for yellow centre of lip, leaves 2–5 on short stem;

trailing inflorescence, 18 ix 1978, *Burtt* 11503 (E); ibidem, ridge SW of B. Lambir, long trailing inflorescence, flower white with translucent veins (very delicate), yellow line below tip of labellum, 26 ix 1978, *Burtt* 11681 (E).

The few leaved shoots with loose clasping leaves of these Lambir plants are very characteristic of *Elettariopsis* but their generic position must remain uncertain until such time as better flowering material is collected. The trailing inflorescence is much elongated and the flowers are borne in remote, many-flowered, cincinni which are very like those of *Elettaria* in general facies. Only in *Elettariopsis triloba* (Gagnep.) Loesen. (Malay Peninsula) is there more than a single flower per bract; and then no more than two. The bracteoles in the above collections clasp each other tightly and appear tubular (as they are in *Elettaria*); but are in fact open to the base. There is a prominent anther-crest but other floral detail, such as the form of the stigma, cannot be satisfactorily distinguished.

6. Elettaria Maton in Trans. Linn. Soc. Bot. 10:250 (1811).

Elettaria is characterized by the very long, normally prostrate inflorescence. The several-flowered cincinni are borne in the axils of distichously positioned bracts and the bracteoles are tubular.

About seven species are known, including *E. cardamomum* Maton, the cardamom of commerce; they are distributed from Sri Lanka to Malaysia and Indonesia.

KEY TO THE BORNEAN SPECIES

1. Inflorescence red with yellow-orange flowers; anther ecristate, the thecae dehiscing by short slits; leaves usually obovate . 1. *E. rubida*
+ Inflorescence greenish brown with white and yellow flowers; anther crested, the thecae dehiscing by pores; leaves lanceolate . . . 2

2. Flowers partly subterranean; calyx fused to the corolla tube for c.2cm above the ovary . . . . . 2. *E. longituba*
+ Flowers held above ground; calyx and corolla tube free above the ovary . . . . . 3. *E. multiflora*

1. Elettaria rubida R. M. Smith in Bot. J. Linn. Soc. 85:66, f. 17a (1982).
Type: Sarawak, 4th Division, G. Mulu National Park, N of camp 1, on clayey slope in hills in lowland rainforest, 200m, 13 ii 1978, *Hansen* 328 (holo. C, iso. E).
Bornean material seen:
SABAH. G. Lamarku, near Sipitang, Mengalom to Milligan path, c.1000m, on ground at edge of rainforest, red inflorescence emerging from ground some way from leaf shoot, flower creamy with yellowish orange lip, 23 iii 1980, *Argent & Lamb* 1549 (E); ibidem, 20 iii 1980, *Argent & Lamb* 1483 (E).
SARAWAK. 4th Division, G. Mulu National Park, ascent from river to moss forest, 14 vi 1962, *Burtt & Woods* B2085 (E); ibidem, 2km NE of camp 1, 7 iii 1978, *Nielsen* 582 (AAU); ibidem, around camp 2, c.500m, 3 viii 1978, *Jermy* 14254 (E).

E. rubida is, as yet, known only from Borneo. It is easily distinguished by the brilliant red inflorescence.

2. Elettaria longituba (Ridley) Holtt. in Gard. Bull. Sing. 13:283 (1950); Smith in Bot. J. Linn. Soc. 85:66 (1982). Fig. 4B.
Type: Malay Peninsula, Pahang, *Ridley* 2403 (K).
Syn.: *Elettariopsis longituba* Ridley in Trans. Linn. Soc. 3:382 (1893) & in J. Str. Br. Roy. Asiat. Soc. 32:156 (1899).
Cyphostigma longituba (Ridley) K. Schum., Pflanzenr. Zing., 274 (1904).
Elettariopsis aquatilis Ridley in Kew Bull. 1925:92 (1925). Type: Sumatra, Lubok Tandai, vii 1922, *Brooks* 7923 (K).
Bornean material seen:
SARAWAK. 4th Division, G. Mulu National Park, S. Melinau to S. Tarikan, petals and calyx reddish outside, white inside, lip white with frilly margin, central base yellow, 15 vi 1975, *Burtt* 8284 (E); 7th Division, Ulu Belaga, S. Semawat, c.250m, hill dipterocarp forest, clayey river bank in riverine forest, pedicels and calyx light green, tinged with red, lip white with a yellow line down the throat, 21 x 1981, *Hansen* 741 (C).

This is the only known species of *Elettaria* in which corolla-tube and calyx are fused together into a solid beak above the ovary. A similar condition is found in the Sri Lankan endemic *Cyphostigma pulchellum*, which also has a prostrate, partially subterranean inflorescence.

In the Malay Peninsula and Sumatra the elongated inflorescences of *E. longituba* may cut across small streams, the flowers appearing above the surface of the water. Ridley's *Elettariopsis aquatilis* is undoubtedly conspecific and the author was incorrect in describing the flowers as singly borne. The Bornean material has a shorter indumentum on the lower leaf surface but cannot otherwise be separated from the type.

3. Elettaria multiflora (Ridley) R. M. Smith, **comb. nov.**
Type: Sumatra, S. Kelantan, near Siak, xi 1897, *Ridley* 8972 (K).
Syn.: *Elettariopsis multiflora* Ridley in J. Str. Br. Roy. Asiat. Soc. 32:157 (June 1899).
Cyphostigma multiflora (Ridley) K. Schum., Pflanzenr. Zing., 273 (1904).
Amomum surculosum K. Schum. in Bot. Jahrb. 27:323 (Oct. 1899). Type: Sarawak, 1st Division, Mt Matang, v 1868, *Beccari* 1586 (FIR).
Amomum stoloniferum K. Schum. in Bot. Jahrb. 27:323 (Oct. 1899). Type: Sarawak, 1st Division, near Kuching, viii 1865, *Beccari* 365 (FIR).
Cyphostigma surculosum (K. Schum.) K. Schum., Pflanzenr. Zing., 273 (1904).
Cyphostigma stoloniferum (K. Schum.) K. Schum., Pflanzenr. Zing., 273 (1904).
Elettariopsis surculosa (K. Schum.) Loesen., Pflanzenfam. 2 Aufl., 15A:603 (1930).

Elettariopsis stolonifera (K. Schum.) Loesen., Pflanzenfam. 2 Aufl., 15A:603 (1930).

Elettaria surculosa (K. Schum.) Burtt & Smith in Notes RBG Edinb. 31:312, fig. 2 (1972).

Recent Bornean material seen:

SARAWAK. 4th Division, G. Mulu National Park, S. Lansat, c.1000m, on side of ridge in submontane forest, inflorescence trailing on the ground, flower white, outer perianth green, inner pink, lip white, 8 x 1977, *Argent et al.* 705 (E); Lambir National Park, ridge E of B. Lambir, 12–1500ft, flower white with yellow centre line to lower part of lip, 25 ix 1978, *Burtt* 11612 (E); 7th Division, Belaga distr., Linau-Balui divide, near camp on S. Dema, c.2000ft, labellum white with yellow channel at base, 6 ix 1978, *Burtt* 11473 (E); ibidem, S. Semawat, c.250m, hill dipterocarp forest, growing in humus and litter on low stream bank, calyx spotted with red, flowers white with a yellow spot at centre of lip, 18 x 1981, *Hansen* 696 (C).

SABAH. G. Lamarku, near Sipitang, Mengalom to Milligan path, c.650m, deep shade, flowers white with green blob on labellum, 20 iv 1980, *Argent & Lamb* 1482 (E).

E. multiflora shows considerable variation in leaf size, the blades of *Argent et al.* 705 and *Burtt* 11612 do not exceed 20 x 3cm, whereas the Belaga plants attain 35 × 7cm. The collection from Sabah and the Sumatran type lie somewhere between these extremes.

As in *E. longituba*, the anther-thecae dehisce by subapical pores, but here the pores are covered by hair-fringed flaps. There is a small, undulating or obscurely three-lobed anther-crest.

A further Bornean collection should be mentioned. *Elmer* 20168 (UC, K), from the Sandakan area of Sabah, was thought by Merrill (*Univ. Calif. Publ. Bot.* 15:32, 1929) to be allied to *Geocharis fusiformis*. From the notes accompanying the UC sheet the plant would seem more likely to belong to *Elettaria* but no inflorescences have been seen.

7. Geostachys Ridley in J. Str. Br. Roy. Asiat. Soc. 32:157 (1899).

Geostachys comprises about 15 species, distributed from Cambodia through Thailand and the Malay Peninsula to Borneo and Sumatra. The structure of the radical inflorescence, which is very often borne on stilt roots, is similar to that of many *Alpinia*. The 2–5-flowered cincinni are subtended by inconspicuous bracts, and the bracteoles are tubular. Flower colour is generally cream with red markings, the labellum three-lobed and the anther crested or not.

The genus divides into two distinct groups; species in which the cincinni arise on one side of the deflexed axis only, and those in which the flowers are borne all round the erect or slightly decurved axis. The sole Bornean representative belongs to the former group.

Geostachys penangensis Ridley, op. cit., 159; Smith in Bot. J. Linn. Soc. 85:68, fig. 8c (1982).

Type: Malay Peninsula, Penang, Government Hill, *Curtis* 327 (K).

Bornean material seen:

SARAWAK. 1st Division, G. Berumpet, 1500m, in humus in upper montane forest, rhizome on prop roots, 13 viii 1962, *Burtt & Woods* B2827 (E); 2nd Division, Mt Liang Laju, vi 1906, *Hewitt* series 427 (SAR); 4th Division, G. Mulu National Park, Sungei Tutuh opposite Long Tao ridge camp, 1200m, ridge top in lower montane forest, bracts brown, peduncles and pedicels red, other tepals yellow, 28 ii 1978, *Hansen* 431 (C).

Corrected Key to Amomum

The following key, which appeared in part I of this Review (*Notes RBG Edinb.* 42:296–298) is reprinted here on account of a number of printing errors in the original.

1. Flowers borne in cincinni; anther dehiscing in upper half only (Group 1) 2
\+ Flowers borne singly; anthers dehiscing throughout their length . 6

2. Inflorescence globose (elongating later); bracts firm textured with a short pungent tip; fruit round with a short neck . 1. *A. lambirense*
\+ Inflorescence conical, even when young; bracts usually papery, without pungent tips; fruit flask-shaped or round and lacking a neck 3

3. Ligule to 3cm long; calyx lobes with prominent subapical spurs; filament present 4
\+ Ligule 1–2cm long; calyx lobes not subapically spurred; anther sessile 5

4. Flowers orange; peduncle bracts 5 × 3cm; leaves to 5cm wide 2. *A. ligulatum*
\+ Flowers white with yellow centre to labellum; peduncle bracts c.4 × 1–1·5cm; leaves 3cm wide or less . . . 3. *A. polycarpum*

5. Leaf tips acute or shortly caudate; flowers c.1·5cm long; anther connective more or less truncate . . . . 4. *A. anomalum*
\+ Leaf tips long caudate; flowers 2·5–3cm long; anther connective deeply emarginate with a small appendage in the cleft . 5. *A. burttii*

6. Corolla tube slender, long exserted from the calyx; bracts pungent 7
\+ Corolla tube more or less equal to or shorter than the calyx; bracts rarely pungent (Group 4) 9

7. Lateral petals centrally connate to each other and to the labellum in the lower half; anther connective ecristate (Group 2) 8
\+ Lateral petals free; anther connective crested (Group 3) 8. *A. sarawacense*

8. Leaves lanceolate (to 5cm wide); inflorescence up to 7 × 4cm; labellum not exceeding the petals . . . . . 6. *A. pungens*
\+ Leaves linear (to 2cm wide); inflorescence up to 4 × 2cm; labellum much exceeding the petals . . . . . 7. *A. hansenii*

9. Leaf shoots 3–4-bladed; ligule bilobed . . . 13. *A. paucifolium*

\+ Leaf shoots frond-like, many-bladed; ligule rarely bilobed . . 10

10. Leaf shoot delicate (under 50cm tall); blades linear; fruit echinate 15. *A. bicorniculatum*
\+ Leaf shoot much more robust; blades rarely linear, if so, then fruit not echinate 11

11. Ligule to 6cm long; entire plant glabrous . 10. *A. macroglossum*
\+ Ligule not exceeding 3cm; plant rarely totally glabrous. . . 12

12. Bracts frilled at margins, with short pungent tips; inflorescence becoming mucilaginous. . . . . 9. *A. coriaceum*
\+ Bracts not as above; inflorescence never becoming mucilaginous . 13

13. Anther-crest absent; petiole, leaf-sheaths and sheaths of the peduncle with very conspicuous hairy reticulations . . 17. *A. dictyocoleum*
\+ Anther-crest always well formed; leaf sheaths etc., if hairy reticulate, then not as conspicuously so as above 14

14. Anther-crest entire or shallowly 3-lobed; bracteole distinctly tubular and remaining so 15
\+ Anther-crest 3-lobed with well-defined side lobes or the mid-lobe occasionally suppressed; bracteole open to the base or tubular at the base only 18

15. Flowers red and white . . . . 16. *A. cerasinum* (ex descr.)
\+ Flowers orange 16

16. Leaf sheaths reticulate; anther-crest obscurely 3-lobed; ovary glabrous . . . . . 11. *A. laxisquamosum*
\+ Leaf sheaths striate; anther-crest semi-lunar; ovary pubescent or verrucose 17

17. Leaves softly hairy below; ovary pubescent . . 12. *A. gyrolophos*
\+ Leaves glabrous; ovary verrucose . . . . 14. *A. oliganthum*

18. Bracteole open to the base, firm textured, enfolded round and almost as long as the bract; flowers predominantly orange 18. *A. xanthophlebium*
\+ Bracteole sometimes tubular at the base never approaching the length of the bract; flowers usually yellow and white . . . 19

19. Peduncle to 35cm; ligule bilobed . . . 19. *A. longipedunculatum*
\+ Peduncle under 15cm; ligule entire 20

20. Leaves distinctly petiolate (petioles to 3cm); leaves pubescent over entire surface below . . . . . 20. *A. luteum*
\+ Leaves sessile or subsessile; glabrous or pubescent on or around the midrib below 21

21. Leaf sheaths reticulate 22
\+ Leaf sheaths striate 24

22. Leaves up to 60 × 10cm; bracts narrowly triangular, papery, markedly striate . . . . . 22. *A. testaceum*
\+ Leaves up to 40 × 6cm; bracts usually broadly triangular, firm, not

markedly striate 23

23. Leaf sheaths pubescent; ligule pubescent . 23. *A. ridleyi* (*sylvestre*)
+ Leaf sheaths glabrous; ligule glabrous . . . 24. *A. flavidulum*

24. Leaves pubescent on midrib below . . . 21. *A. flavo-album*
+ Leaves glabrous . . . . . .25. *A. sp.*

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